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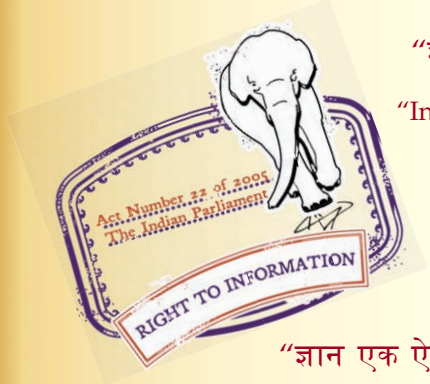

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IS : 10808 - 1984
(Reaffirmed 2000)

Indian Standard

CODE OF PRACTICE FOR INSTALLATION OPERATION AND MAINTENANCE OF HYDRAULIC RAMS

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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May 1984

Indian Standard

CODE OF PRACTICE FOR INSTALLATION OPERATION AND MAINTENANCE OF HYDRAULIC RAMS

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Indian Standard

CODE OF PRACTICE FOR INSTALLATION OPERATION AND MAINTENANCE OF HYDRAULIC RAMS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 February 1984, after the draft finalized by the Irrigation Equipment and Systems Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 The hydraulic ram is a simple automatic device with which the energy of a quantity of water with small head is used to lift proportionate quantity of this water to a greater height. Considering its advantages over conventional method of lifting water, particularly in hilly areas, its manufacture and use is increasing. A need has, therefore, been felt to prepare a standard giving guidelines for proper installation and operation of hydraulic rams for people engaged in use, manufacture and extension of this equipment.

0.3 In preparation of this standard, assistance has been derived from the following organizations:

a) Machinery Division, Ministry of Agriculture, Government of India, New Delhi; and

b) State Planning Institute, Planning Department, Government of Uttar Pradesh, Lucknow.

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1. SCOPE

1.1 This standard provides guidelines for installation, operation and preventive maintenance of hydraulic rams, also known as hydrams.

2. GENERAL LAYOUT AND FUNCTIONING

2.1 A general layout of the hydraulic ram system is shown in Fig. 1 for guidance.

2.2 Water from the stream flows through the intake tank and the intake pipe into the valve chamber, Since the impact valve rests at the bottom position due to its mass, water flows through the waste water outlet. As the velocity of water in the intake pipe increases due to the hydraulic

gradient provided, the force on the hinged impact valve increases and closes it suddenly thus causing water hammer in the system. This results in sudden increase in the water pressure which lifts the delivery valve and pushes the pressurised water into the air chamber. Air in the air chamber gets compressed to give a cushioning effect and the water is gradually forced into the delivery pipe. After the momentum of water into the intake pipe is spent, the compressed air and the pressurised water closes the delivery valve. Simultaneously backward motion of water in the intake chamber and intake pipe occurs causing a negative pressure in the valve chamber. The impact valve which is hinged on a steep angle in the valve chamber, falls back due to this vacuum and to its own mass and allows water to flow through the waste water outlet. As the velocity of the water in the intake pipe increases, the impact valve again closes suddenly and the cycle is repeated. The waste water from the waste water outlet of the hydram may also be used for flow irrigation at lower spots.

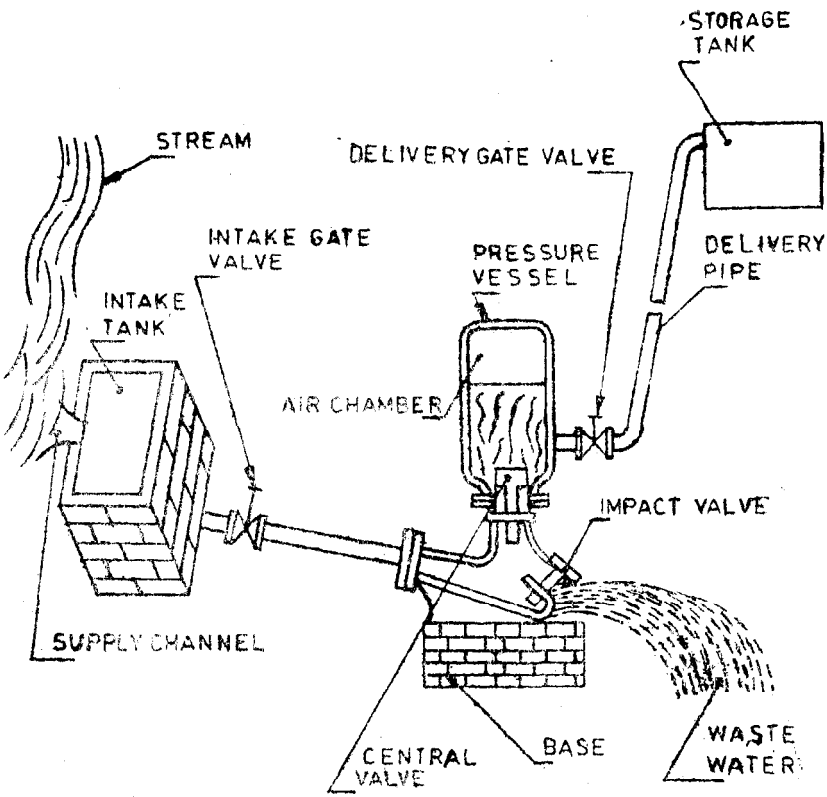

FIG. 1 GENERAL LAYOUT AND FUNCTIONING OF HYDRAM

3. SELECTION OF SITE FOR HYDRAM

3.1 The following points should be taken into consideration while selecting the site for hydrams:

a) Quantity of water available in the stream during the cropping season,
b) Gradient of the stream,
c) Height of the field from stream bed,
d) Distance of the highest cultivated field from the stream,
e) Total cultivable land proposed for irrigation,
f) Existing and proposed cropping pattern,
g) Average monthly rain fall, and
h) Depth and frequency of irrigation.

4. SELECTION OF HYDRAM

4.1 Proper size of hydrams (*see* IS : 10809-1984*) shall be selected on the basis of data obtained under **3.1**. Normally hydram functions at 2 to 30 lift magnification.

5. INSTALLATION

5.1 Dam — A working head or drop is necessary for operating the hydram. At some places, only ordinary stone wall will divert the required quantity of water into supply channel and the desired drop is obtained. But in most of the cases it is essential to raise the level of water which is possible only through gravity dams.

5.2 Supply Channel — A supply channel, mostly *pucca* should be constructed to convey the water into intake tank. The size of channel may be decided on the basis of water needed to operate the hydram.

5.3 Intake Tank — It is also known as feeding tank or filteration tank. It should be strong enough to resist the vibration of water hammering. The capacity of supply tank for various sizes of hydram is given in Table 1 for guidance.

*Specification for hydraulic rams.

TABLE 1 CAPACITY OF TANK

(*Clause* 5.3)

Sl No.	Size of Hydram	Capacity
(1)	(2)	(3)
	mm	l
i)	50 × 25	200
ii)	75 × 38	1 000
iii)	100 × 50	2 000
iv)	150 × 75	6 000
v)	200 × 100	10 000
vi)	300 × 150	25 000

5.3.1 The depth of the tank should be minimum 1 m and 0·5 to 0·7 m head of water should be maintained in the intake tank above the mouth of intake pipe to avoid sucking of air in intake pipe during operation. A portion of this tank may also be used for separation of straw, leaves, etc through filteration, and sand through sedimentation.

5.4 Hydram Foundation — The foundation of the hydram for sizes exceeding 100 × 50 mm and for heads exceeding 30 m should be constructed with reinforced cement concrete in accordance with the instructions of the manufacturer. The hydram should be held in horizontal position with adequately strong foundation bolts. A hard packing should be placed under the ram to avoid effect of vibration on the foundation.

5.4.1 The hydram units shall be well protected from flood water, land slide, etc.

5.5 Intake Pipe — Intake pipe should be of high pressure type to withstand water hammer. In length it should be laid eight times of the intake head and at an angle of 7°.

5.6 Delivery Pipe — The discharge of a hydram is inversely proportional to the delivery head. When water is tapped at low head, the discharge and velocity of water are higher than at a higher head, assuming the delivery line to be uniform size. Under such condition there is greater frictional head caused unnecessarily. In order to raise the efficiency of the hydram under a situation of high discharge against low head, it is desirable to use larger diameter pipe at the base of the delivery line and to reduce the size of the delivery line in steps subsequently. The size of the delivery pipe line at different levels in relation to the intake pipe should be selected according to the magnification factor as given in Table 2.

TABLE 2

(*Clause* 5.6)

Sl No.	Magnification Factor	Ratio of Diameter of Delivery Pipe to Intake Pipe
(1)	(2)	(3)
i)	Up to 10	1 : 2
ii)	10 to 20	1 : 4
iii)	20 to 30	1 : 6

5.6.1 For example if the drop is 6 metres lifting height ranges to 180 m and the diameter of intake pipe is 200 mm, the delivery pipe line should be laid as follows:

Delivery Head	*Size of Delivery Pipe*
Up to 60 m	100 mm
60 to 120 m	50 mm
120 to 180 m	40 mm

5.6.2 It is advisable to lay the delivery pipe on the shortest possible route to economise cost and to achieve high efficiency. Hydrants should be provided in the delivery pipe line at different levels to irrigate fields with the minimum pumping head. Also in the laying of delivery pipe line, sharp bends should be avoided to reduce frictional resistance to the flow of water for achieving higher efficiency.

5.7 Reservoir — In case of a big size hydram or battery of hydrams, water may be efficiently applied to the field directly, particularly if an underground irrigation system is laid. But in most of the cases, it is desirable to store water overnight in a reservoir to apply it through the water channels in the day time. A reservoir may be earthen with appropriate lining or of cement construction. The capacity of reservoir depends upon the pumping capacity of the hydram for the height or maximum for 24 hours. Reservoirs normally required are in the capacity range of 50 to 150 m^3.

5.8 Drain — Arrangement should be made to drain out the waste water through a *pucca* channel or pipe line to the point where it may not harm the Hydram foundation.

5.9 Utilization — Lifted water may be utilized either for irrigation or for drinking purpose. For irrigation, systems, like gravity flow, sprinkler, etc, may be used depending upon the situations.

5.10 Battery of Hydrams — Hydraulic rams may be installed in a battery under following situations:

a) The pumping capacity of the biggest available size of the hydram may not meet the requirement.

b) When discharge of the water available from the stream varies significantly over the season, the hydrams are installed in a battery to operate one or more according to the availability of water.

c) After having installed a hydram, it may be experienced that not full discharge of the water in the stream is made use of.

5.10.1 Another hydram of a suitable size may be added in a battery to increase the discharge instead of going for a completely new bigger hydram at a very high cost. The size of the delivery pipe may be increased initially to accommodate the discharge of the additional hydram or a separate delivery line may be placed up to the lowest hydrant. Then it may be connected to existing line.

6. OPERATION

6.1 Starting of the Hydram — Following points should be observed while starting the hydrams:

a) Check that there is no leakage in the pipeline.

b) Close the gate valve on delivery pipe line. Open the gate valve fully on the intake pipeline and wait till no-air-bubbles come out of the drive pipe.

c) Operate the impact valve for about 15 strokes till it starts working automatically. For this purpose use a stick, plier or a pair of tongs. Do not hold the bolt of the impact valve with hand lest it is injured with impact of the valve. Use starting handle, if provided.

6.2 Tuning of the Hydram — Tuning aims at maximizing the output of the hydram for the highest efficiency. Increase in the time duration of the cycle of the impact valve (or in other words decreasing the number of cycles per minute) increases the water input through the hydram because of attainment of full velocity. Because of the high velocity of drive water, effect of hammering is the highest and the conversion of the kinetic energy into pressure energy is the maximum. Higher delivery heads require lesser frequency of the cycles of impact valve. For reducing the frequency of the cycles of impact valve, either extra mass is added to it or the adjustable bolt is unscrewded. For increasing the frequency of the impact valve (for low or medium head) reduce mass on the valve or screw in the bolt. Take actual measurement of discharge of water while tuning.

7. MAINTENANCE

7.1 Hydram operates continuously for years without requiring much maintenance as there are only two moving valves in the machine. The rubber thrust pads on the impact valve and the delivery valve require to be changed once or twice in a year. The hinge pins are water lubricated and their wear is very slow.

7.2 The pump and the pipe lines when not in operation should be drained off particularly in extreme winter conditions to prevent bursting of the pipes.

8. TROUBLE SHOOTING

8.1 Some of the common troubles and their remedies are given below for the guidance of the user:

Trouble	*Remedy*
a) Unusual noise from the hydram and intense vibration at the delivery pipe	There is no air in the chamber. Stop the hydram, close the delivery gate valve and release water from air chamber to induce air in it. Ensure that there is no leakage of air at the air vessel joints before restarting.
b) Impact valve remains closed or open after repeated starting by hand	When the impact valve remains closed the mass on it is less. In case it remains open the mass on it is more. Adjust the mass accordingly. Also ensure that the valve hinges do not stick and there is no blockage of water through leaves and straw in the ram.
c) Impact valve works for a few strokes and then stops	There is air in the drive pipe line. Evacuate the air by closing impact valve for some time.
d) Hydram works without any discharge of water	The seat of the delivery valve may be worn out and leaking. Replace the valve packing and recondition the seat. Also ensure that magnification factor does not exceed 30.